

**Abstract**

A turbine power system that includes a compressor for compressing a first medium, and an electrochemical converter in communication with the compressor and adapted to receive the first medium and a second medium. The converter is configured to allow an electrochemical reaction between the first and second mediums, thereby generating electricity and producing exhaust having a selected elevated temperature. The power system further includes a turbine in fluid communication with the electrochemical converter and adapted to receive the converter exhaust, such that the turbine converts the electrochemical converter exhaust into rotary energy and electricity. The system can further include a steam generator and a steam turbine that produces electricity. The electrochemical converter is utilized herein as an electrochemical combustor-replacement (ECCR) or as a fuel cell for combustor-replacement (FCCR).